

having a special theory of his own. According to the generally accepted interpretation the great movement of the ages has been in the direction of increasing complexity and control (differentiation and integration), always allowing for some simplification in the case of parasites and other degenerates. But according to Dr. Marconi's interpretation the historic movement has been in the opposite direction. Mammals did not evolve from a Reptilian stock, but Reptiles from Mammals. Amphibians did not spring from a Piscine stock, but Fishes from Amphibians. The mistake that evolutionists have made in contemplating the stream of life is not a little one; they have actually mistaken the direction of the current! The author asks us to replace the evolution-idea by the involution-idea.

This arch-heresy has been suggested before, but it has never had, so far as we know, such an elaborate and beautifully printed presentation. The author is obviously sincere and in earnest, but he has not learned the humility of refraining from discussing questions, such as cell-division, which he has utterly failed to understand. What are we to say of this ingenuous and occasionally ingenious heretic?

There was a time long ago when our earth was too hot to offer hospitality to any living creatures of the sort we know about, and it is useless to speak of others. Therefore, so far as the earth is concerned, "matter" antedated "life." But it is open to anyone to defend the metaphysical thesis that in the world as a whole "life" is antecedent to "matter." We would not quarrel with Dr. Marconi over a luxury of this sort. But when we remember the fact that according to the rock record there were invertebrates before there were any vertebrates, and fishes before there were any amphibians, and reptiles before there were birds and mammals, and so on, we require arguments more cogent than Dr. Marconi's to persuade us to become "involutionists." And as to the development of the individual, while we agree with the author that the recapitulation doctrine requires careful handling, we do not think that the life-history of a frog, for instance, offers any suggestion whatsoever of the reptilian origin of amphibians.

We shall not discuss Dr. Marconi's detailed arguments that cyclostomes sprang from gnathostomes, and ascidians from amphioxus, and echinoderms from enteropneusts, and the branchial arch system of a dogfish from the thoracic skeleton of a mammal, for in truth what he says lacks zoological competence. It would have been profitable if Dr. Marconi had followed Dr. Dohrn and Sir Ray Lankester and restricted himself to

illustrating the occasional occurrence of degenerative or involutionary changes in the history of animal life, but the author will have no half-measures. From an originally perfect manifestation of life man has fallen; and the ape and the tiger, the mole and the bat are his descendants!

When we read the words "involution naturelle" on the title-page we hoped that some light would be cast on Prof. Bateson's recent hard saying: "We may as well see whether we are limited to the old view that evolutionary progress is from the simple to the complex, and whether after all it is conceivable that the process was the other way about." But while Dr. Marconi is convinced that it has been the other way about, he starts from a super-man, and we do not suppose that this expresses Prof. Bateson's conception of primordial life. In one of Dostoevsky's novels it is quaintly remarked of one of the characters that he was the only man in the company who could move about on his head. We think that the author of this extraordinary, topsy-turvy interpretation of the world must be similarly unique.

ELECTRICITY FOR THE FARM.

Electricity for the Farm. By F. I. Anderson. Pp. xxiii+265. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1915.) Price 5s. 6d. net

THIS book is addressed particularly to American farmers who may not know how easy it is to make use of a stream of water in producing electric power and transmitting it for lighting and heating and mechanical purposes on a farm. It shows that the initial cost is usually small, that measurement of power is simple, that although the farmer must buy apparatus he can do this without employing an expert, and that he need have no difficulty in putting it up and getting it to work in such a way that it will give no trouble afterwards.

The author knows his farmer well, and his explanations are obviously such as will be understood. How to compute the power required for so many lamps in rooms and out-houses; for so many heaters of various kinds; for so many motors doing small or large domestic or farm work. How to measure the amount of water flowing in a stream, and knowing the fall to calculate the power of the stream. The farmer or his son, who will probably become an enthusiast, is supposed to have much common sense and a knowledge of simple arithmetic; he will certainly in time get a good working knowledge of electrical engineering. The author makes remarks which may cause a physicist to smile; for ex-

ample, "a falling body hits the ground with precisely the same force as is required to lift it to the height from which it falls." He evidently means that the work done in lifting the body is equal to the energy which it will expend in falling. His instructions as to the measurement of water by weirs are too inaccurate to please a water engineer, but they are really accurate enough for the farmer's purpose. His descriptions of turbines are too complex for the farmer and they do not show great knowledge of the subject, but the farmer does not need to understand them. The author is excellent in describing how to make a dam. His description of the dynamo is quite good and easy to follow, and it will certainly interest the farmer in electricity and cause the farmer's son to study the subject more fully, not merely through books, but through simple experiments. On practical matters—types of lamps, sizes of wire, wire joints, Ohm's law, wiring the house and premises, etc.—the author gives good simple instructions. The last quarter of the book is less important; it is intended for farmers who have no water power. It describes gas-engine plant and accumulators.

The American farmers have a respect for natural science and they are glad to cultivate new ideas. We think that the publication of this book will induce such men and their families to begin a fascinating study at small cost, with results in comfort and a widening of the mental horizon which ought to fill the town dweller with envy.

PRINCIPLES OF STOCK-BREEDING.

Breeding of Farm Animals. By Prof. M. W. Harper. Pp. xvii+335. (New York: Orange Judd Co.; London: Kegan Paul and Co., Ltd., 1914.) Price 1.50 dollars.

FEW callings have been more prolific in theories than stock-breeding. Many have been erroneous, while others which have borne a strong semblance of soundness have been inapplicable. Most of them have come from stock-breeders themselves; but others, which, as a rule, have received more attention, have come from outside observers. The great stock-breeders, more especially the great improvers, have given little heed to any other theory than that which has been tersely expressed in the words "put the best to the best," but others have been influenced by other theories, although their success in the production of good stock has usually been parallel with the strength of their adherence to the main theory whether that adherence was conscious or unconscious. After the introduction of printed herd and stud books, and therefore of "pure" breeding, the

"pedigree" theory was generally taken to be a means of breeding good stock as well as "pure" stock, and only the very greatest stock-breeders stood fast by the "best to best" theory.

Like many a stock-breeder, Prof. Harper has lost sight of the main theory, and has allowed others to intervene. With him the Darwinian theory has effect as follows: "While the influence of climate and locality is great, and the factors at work are exceedingly complex, yet from a practical point of view we may consider the food supply and more favourable conditions generally, such as sufficient shelter, proper care, including training and developing, as the more important causes of variation." A paragraph is headed "Mendelism a Cause of Variation." And, after three chapters on Improvement due, 1, to "selection based on records of performance," 2, to "selection the result of prepotency," and, 3, to "cumulative development," it is stated "that the degree of development depends on the environment, including training, management, and the like." Apparently the weight of Bateson's "Materials for the Study of Variation," and Mendel's work has not yet been felt. It is no argument for the Darwinian view to say that "The thoroughbred horse has increased its speed by but eight per cent. in one half a century of racing. During this same period the standard-bred, a comparatively new breed, has reduced its trotting record by 27 per cent." The words in italics indicate some part of the argument to the contrary.

Parts of the work of Galton and Pearson are cited, but with no indication how the formulæ of these investigators, even if sound, are to be made use of by stock-breeders; and the idea that "the new individual inherits all the characters of the race to which it belongs," which is cited frequently and appears to be regarded as fundamental, is of very doubtful accuracy when applied to domestic animals. In the chapter headed "Mendel's Law of Heredity," the statements are made that "Mendel made a series of studies . . . from which he drew some general conclusions, now known as Mendel's law of heredity," and "Mendel's Law . . . depends on three factors—unit characters, dominance, and segregation." Apparently Prof. Harper has become acquainted with Mendel's Law from later writers rather than from Mendel himself.

In his volume, however, a source of information of very great importance is indicated. In the United States, careful records have been kept of the performances of the Holstein-Friesian breed of cattle, and these show that, as they had none, or one, or two parents in what is called the ad-